Expansions exceeding the limit, $v_2/v_1 = 1{\cdot}38$, however, give fogs, which increase rapidly in density, *i.e.* in the number of the drops, as the expansion is increased beyond this second limit. The expansions required for the rain-like and cloud-like condensations correspond to a fourfold and eightfold supersaturation respectively.

A further experiment will throw light on the nature of the nuclei associated with the rain-like condensation. Let us expose the moist air to the action of X-rays before causing it to expand. First let us try an expansion very slightly less than that required to give the rain-like condensation without the rays. You observe no drops are formed. Now let the expansion be slightly greater than the critical value 1·25. A fog is seen on expansion. Thus the X-rays produce in the air immense numbers of nuclei having the same properties, so far as their power of assisting condensation goes, as the comparatively few nuclei which the rain-like condensation makes visible. Now a gas exposed to X-rays conducts electricity, and the otherwise complicated phenomena of this conduction are all reduced to comparative simplicity by the theory that under the action of the rays equal numbers of freely moving positively and negatively electrified bodies (the ions) are produced from the originally neutral gas. It is at once suggested that the condensation nuclei produced by X-rays are simply these ions.

Let us now impart conducting power to the gas by exposing it to the action of the radiation from radium. Again we have the same result; no drops are produced if the expansion be less than 1·25, fog if the expansion exceeds this limit.

If we substitute for the glass shade, which has thus far formed the cloud-chamber, a glass cylinder with a horizontal metal top, we have the means of testing whether the condensation nuclei produced by Röntgen or radium rays are really electrically charged, whether, in fact, it is the ions themselves which act as condensation nuclei or other particles produced by the rays. If, for example, the roof of the cloud chamber be kept positively charged, the floor negatively, the negatively charged ions will travel upwards and the positively charged ones downwards. In the absence of an electric field the positive and negative ions produced by the action of the rays will go on increasing in number until as many are neutralised by recombination with ions of the opposite kind, or by coming in contact with the walls of the vessel, in each second as are set free in that time by the rays. If the rays be cut off, the removal of ions by recombination and diffusion will continue, and the number of ions in the vessel will diminish rapidly.

Experiment shows that, while in the absence of an electric field, quite a considerable fog is formed when an expansion, slightly exceeding 1·25, is effected ten seconds after the rays have been cut off, with 200 volts between the upper and lower plates the same expansion, allowed to take place three or four seconds after the stopping of the rays, produces only a very slight shower. Or, again, if the rays be kept on all the time the resulting fog is very much less dense with the electric field acting than without it. These results are easily explained if we assume that the condensation nuclei are the ions, and apply the result obtained by purely electrical methods, that the ions travel about 1·6 cm. per second in a field of 1 volt per cm. The nuclei causing the rain-like condensation without exposure to Röntgen or radium rays are also removed by the action of an electric field; we have thus the direct proof that they also are ions. Recent experiments have proved that a charged conductor suspended within a closed space loses its charge by leakage through the air, and that the conduction shows all the peculiarities of that met with in an ionised gas; and, indeed, it appears that this ionisation is due to the action of radiation of the radium type from the walls of the vessel and from outside the vessel. The condensation method of detecting ions is, it may be pointed out, a very delicate one; a single ion if present in the vessel will be detected.

The positive and negative ions are not alike in their power of acting as condensation nuclei. In most of the experiments shown to-night the negative ions alone have in fact come into action. The positive require a considerably greater expansion in order that water may condense upon them. The final volume must for the positive ions be about 1·31 times the initial instead of only 1·25, corresponding to a sixfold instead of a fourfold supersaturation.

To demonstrate the difference between the positive and negative ions the same form of apparatus is used as in the previous experiment. Instead, however, of a difference of potential of 200 volts, only 2 or 3 volts are applied between the plates; and in this experiment only a thin layer close to the lower plate is exposed to the action of the rays. Under these conditions, if the upper plate is the positive one, the negative ions will be attracted upwards out of the ionised layer, and will occupy the greater part of the volume of the vessel, while the positive ones will have only a short distance to travel before reaching the lower plate. If the rays be cut off before the expansion is made it is easy to arrange the interval to be of such a duration that all the positive ions have been removed, while only a small fraction of the negative ions have reached the upper plate before the expansion takes place. Thus we can try the effect of expansion when the vessel is charged with practically negative ions only. By reversing the electrical field the action of positive ions, almost free from negative ions, can be studied. When the expansion is between 1·25 and 1·31 a fog or a mere shower is obtained, according as the direction of the field is such as to drive negative or positive ions upward.

The ions are by no means the only nuclei which can be produced within moist air from which the dust particles have been removed. Among the most interesting of such apparently uncharged nuclei are those produced in moist air exposed to ultra-violet light. It is impossible in the time available to do more than allude to them here.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—The reader in animal morphology (Mr. Sedgwick) gives notice that a special course of advanced lectures on certain general aspects of zoology will be given at the zoological laboratory during the Michaelmas and Lent terms, beginning Friday, October 28. The course will include lectures by the following, and will be given as nearly as possible in the order indicated:—Michaelmas term: Mr. Doncaster, the nucleus and heredity; Mr. Lister, Foraminifera and Mycetozoa; Mr. Punnett, metamerism. Lent term: Mr. Gardiner, the œcology of aquatic animals; Mr. Brindley, certain aspects of regeneration; Mr. Hopkins, animal pigments; Mr. Fletcher, cell-structure, cell-division, and maturation of germ-cells; Mr. Heape, some problems connected with the comparative physiology of the generative system.

Dr. Donald MacAlister, St. John's, who has represented the university on the General Medical Council since 1889, and is now chairman of the British Pharmacopœia Committee, was re-elected for a fourth period of five years on October 24.

A university lectureship in applied mathematics is vacant by the appointment of Mr. H. M. Macdonald to be professor of mathematics in the University of Aberdeen. The readership in botany is vacant by the resignation of Mr. Francis Darwin. These offices will be filled up during the present term.

The Gedge prize in physiology has been awarded to Mr. K. Lucas, fellow of Trinity, for his paper on "The Augmentor and Depressor Effect of Tensions on the Activity of Skeletal Muscle."

The number of students of the first year matriculated on October 21 was 884, or for the whole year up to that date 923.

The late Mr. Henry Evans, of Trinity College, bequeathed to the university his collection of British Lepidoptera.

The following examiners have been appointed for the natural sciences tripos:—Physics, R. T. Glazebrook and W. C. D. Whetham; chemistry, H. O. Jones and Prof. A. Smithells; mineralogy, Prof. W. J. Lewis and L. J. Spencer; geology, A. Harker and Dr. F. A. Bather; botany, A. C. Seward and H. Wager; zoology, A. Sedgwick and Prof. W. A. Herdman; physiology, W. M. Fletcher and Prof. E. Waymouth Reid; anatomy, Dr. E. Barclay Smith and Prof. A. Robinson.

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LORD KELVIN will be installed as Chancellor of the University of Glasgow in the Bute Hall on Tuesday, November 29.

PROF. WINDLE, Dean of the Medical Faculty at Birmingham University, has been appointed to the presidency of Queen's College, Cork, in succession to Sir Rowland Blennerhassett.

PROF. HARRY E. CLIFFORD has been appointed acting head of the department of electrical engineering at the Massachusetts Institute of Technology, Boston, in succession to Dr. Louis Duncan, resigned.

AT a meeting of the governors of the South-Eastern Agricultural College at Wye, held on Monday, October 24, it was decided to develop further the forestry department, for which a grant will be sought from the Board of Agriculture.

MR. SIDNEY H. WELLS and the Rev. James Went have accepted the invitation of the President of the Board of Education to serve on the consultative committee in place of Prof. Henry E. Armstrong and the Rev. Dr. Gow, who retire in accordance with the terms of the Order in Council by which the committee was constituted.

YALE University, it is reported, will receive by the will of Mr. Levi Clinton Veits the sum of about 40,000*l.* We learn further from *Science* that the veterinary department of the University of Pennsylvania has received an anonymous gift of 20,000*l.*, Columbia University a gift of 3250*l.* from Mr. H. E. Garth for the establishment of a scholarship, and 2000*l.* from an anonymous donor for the purchase of books.

A WELSH national conference on the training of teachers is to be held at Shrewsbury on November 10 and 11. Representatives from the Court and Senate of the University of Wales, from the Council and Senate of each of the Welsh university colleges, from the local education authorities, the local governing bodies, as well as from the educational associations throughout Wales, are expected to be present. The conference will be fully representative, and is expected to have important results.

BY the will of the late Dr. Isaac Roberts, the reversion of his residuary estate, probably between 30,000*l.* and 35,000*l.*, is to be divided equally between the University of Liverpool and the University Colleges of North and South Wales, for the purpose of founding scholarships. In the award of the scholarships preference is to be given to persons studying or intending to study astronomy, biology, zoology, botany, chemistry, electricity, geology, and physics, under conditions determined by the councils.

NEW physical and engineering laboratories were opened at the York Railway Institute of the North-Eastern Railway Company on October 20 by Sir Edward Grey. During the course of an address, Sir Edward Grey said he was convinced that no country was more qualified by nature and brains to make use of good scientific training than our own, and, therefore, there was all the more reason why there should be good opportunities of acquiring it. In the great struggle for success everything depended on the use made of scientific discoveries.

DR. C. POMERANZ has been appointed assistant professor of chemistry in the University of Vienna, Dr. Johannes Königsberger assistant professor of theoretical physics at Freiburg, and Dr. Paul Rabe, of Jena, has been raised to the standing of assistant professor at Jena. Profs. H. Joly (mathematics) and A. Dommer (mechanics), of Lausanne, have been raised from the rank of assistant to that of ordinary professor. Dr. Sommer has been appointed professor of mathematics at the Danzig Technical College; Dr. Kurlbaum, of the Charlottenburg National Physical Laboratory, has been appointed ordinary professor at the Berlin Technical College; and Dr. Max Bodenstein assistant professor of chemistry at the University of Leipzig.

THE meeting of teachers engaged in London polytechnics, technical institutes, and schools of art, announced in our last issue, was held at Birkbeck College on October 22, to promote an association of technical teachers for the advancement of technical education generally, interchange of ideas on methods of teaching, and the safeguarding of professional interests. The following resolution was adopted by a large majority:—"That this meeting hereby decides to form an association of science, technological, and art teachers engaged in the London polytechnics, technical institutes, and schools of art, such association to comprise both permanent staffs and evening teachers, other than those engaged in purely secondary work." An executive committee of fifteen members was appointed to draft rules and constitution, and to report to a general meeting to be held in January.

A COPY of the prospectus for 1904–5 of the Leith Nautical College has been received. The college is devoted wholly to technical instruction in subjects directly connected with the sea. It is equipped with physical and mechanical laboratories and appliances for every branch of nautical education. Experimental work is provided in magnetism and electricity in regard to their seafaring application, in the teaching of seamanship, and in shipbuilding. The teaching arrangements are framed to suit the needs of the migratory seafaring community; for students can enter at any time, and can attend for long periods or for recurring short periods, as may be convenient to them. The work of the college, as the programme of instruction shows, is in no way limited by the requirements for the Board of Trade examinations, but every facility is offered in the numerous subjects of a higher naval education. Among courses of study included in this programme may be mentioned those on oceanic meteorology and instruments, with the bearing of meteorological elements on ocean routes, and on ship manœuvring in cyclones; on shipping and commercial law, including the commercial duties of a shipmaster; and on ship surgery, medicine, and hygiene at sea. Special classes have been arranged for fishermen in fisherman's navigation, weather knowledge, knotting and splicing, and in rigger's work.

SOCIETIES AND ACADEMIES.

PARIS.

Academy of Sciences, October 17.—M. Mascart in the chair.—On the four first numbers of the photographic catalogue of the heavens published by the Observatory of Toulouse: M. **Lœwy.** The parts now published contain the rectilinear coordinates of 32,275 stars, obtained from 186 negatives. The introduction to vol. ii., by M. Baillaud, also gives a complete account of the method of reduction followed at Toulouse, as well as of the special methods used in the measurements of the coordinates and for the calculation of the constants. An account is also given of the method adopted for measuring the relative magnitudes of the stars and of an experimental study of the photographic objective employed. Statistical studies made at the Observatories of Oxford, Toulouse, and Potsdam have shown that the mean distribution of the star images in the negatives of the catalogue is not uniform, and prove that the focal surfaces of the six objectives studied (Algeria, Oxford, Paris, Potsdam, San Fernando, and Toulouse) have an appreciable curvature.—The study of the third group of air bands with a strong dispersion: H. **Deslandres** and A. **Kannapell.** A detailed description is given of the study of the third group of air bands occupying the more refrangible half of the ultra-violet region (λ 3000 to λ 2000). The general result confirms the conclusions arrived at in 1885, each band under strong dispersion being always formed of eight series of rays in arithmetical progression. A drawing is given for the band λ 2370, in which this structure is clearly shown.—On a new system of micrometers: G. **Millochau.** The wire micrometer, which is attended with certain inconveniences, is replaced by an instrument based on the principle of the heliometer. Two identical plates of glass with parallel faces are placed in a plane perpendicular to the optical axis of the telescope employed, between the objective and the eye-piece. The plates turn round a common axis and give rise to a double image of the star, the distance between the two images being practically independent of small displacements of the telescope.—Observations of the sun made at the Observatory of Lyons with the 16 cm. Brunner equatorial during the second quarter of 1904: J. **Guillaume.** The results are summarised in three tables giving the number of spots, their distribution

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